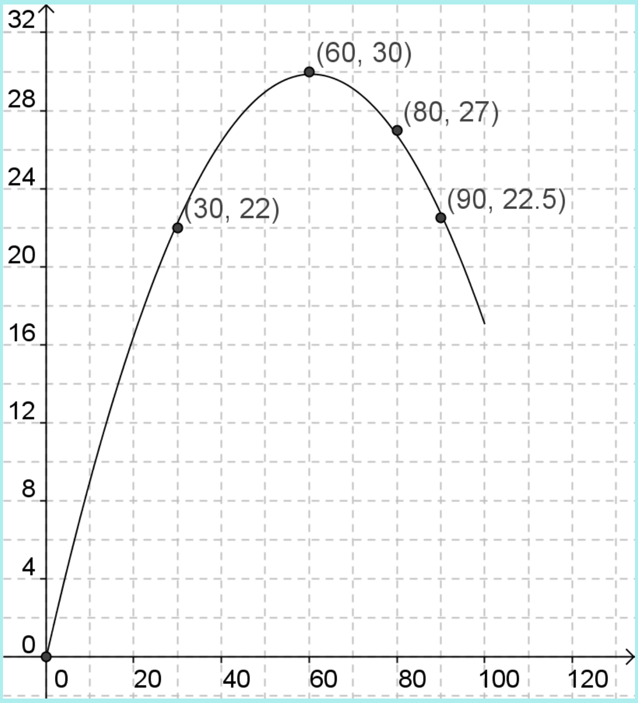
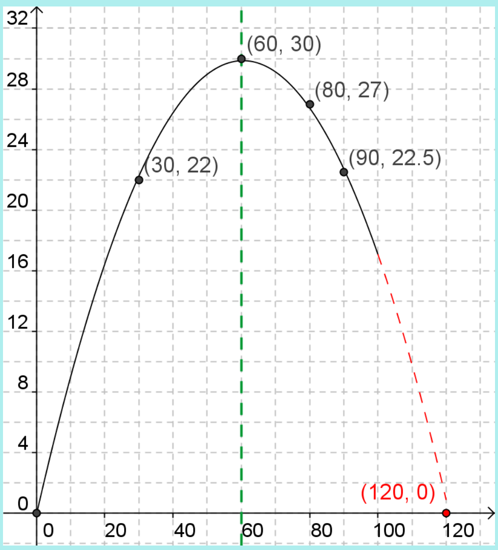
Data from the flight of a golf ball are graphed below. Identify key features that could be used to model the path using factored form or standard form.

$y = a(x - s)(x - t)$ $y = ax^2 + bx + c$





- one zero at (0, 0)
- y-intercept at (0, 0)

- max at (60, 30)
- axis of symmetry x = 60

- other zero must be at (120, 0) by symmetry

standard

$y = ax^2 + bx + c$

factored

$y = a(x - s)(x - t)$

L10(3.3) - Modelling Quadratics Using Factored and Standard Form

1) Sketch the parabola, if possible.

2) Identify the key properties given.

3) Use symmetry to deduce other key properties.

4) Select the equation based on key properties:

   factored form: at least one zero, two other points

   standard form: y-intercept, two other points

5) Substitute given information or points to solve for any missing values.

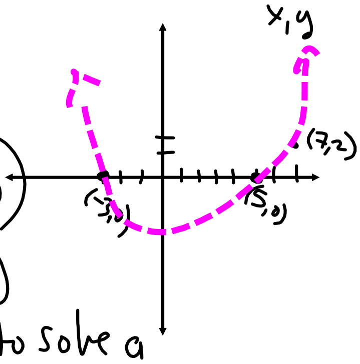
6) Does your answer make sense? Is there agreement with key features? Can you predict others?

Ex.1 Find the equation, in factored form, of the quadratic that passes through the points (-3, 0), (5, 0) and (7, 2).

$y = a(x-s)(x-t)$

$y = a(x-(-3))(x-(5))$

$y = a(x+3)(x-5)$



sub x=7 and y=2 in to solve a

$2 = a(7+3)(7-5)$

$2 = a(10)(2)$

$\frac{2}{20} = \frac{20a}{20}$

$\boxed{a = \frac{1}{10}}$

∴ the equation is

$y = \frac{1}{10}(x+3)(x-5)$

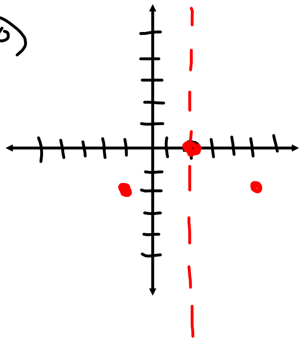
Ex.2 Find the equation of the parabola, in factored form, that has only one zero, which is 2, and that passes through the point (5, -2).

(2, 0)

$y = a(x-s)(x-t)$

$y = a(x-2)(x-2)$

$y = a(x-2)^2$



Sub (5, -2) to solve a

$y = a(x-2)^2$

$-2 = a(5-2)^2$

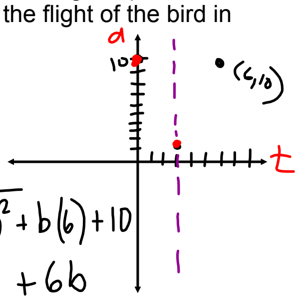
$-2 = a(3)^2$

$\frac{-2}{9} = \frac{9a}{9}$

$a = -\frac{2}{9}$

$\therefore y = -\frac{2}{9}(x-2)^2$

Ex.3 A bird swoops from a branch 10 m above the ground.
After 3 seconds it is 1 m above the grass, and then it flies to a perch in another tree. Assuming the path is *approximately parabolic*, model the flight of the bird in standard form.



$y = ax^2 + bx + 10$

(3, 1)

$1 = a(3)^2 + b(3) + 10$

$-9 = 9a + 3b \quad \times 2$

(6, 10)

$10 = a(6)^2 + b(6) + 10$

$0 = 36a + 6b$

$-18 = 18a + 6b$

$-\quad 0 = 36a + 6b$

$-18 = -18a$

$\frac{-18}{-18} = \frac{-18a}{-18}$

$a = 1$

sub a = 1 into ①

$-9 = 9a + 3b$

$-9 = 9(1) + 3b$

$-9 - 9 = 3b$

$\frac{-18}{3} = \frac{3b}{3}$

$b = -6$

$\therefore$ the equation is
$\boxed{y = x^2 - 6x + 10}$

Assigned Work:

p.175 # 1, 2, 4, 6, 9ab, 11, 15*